uses of public weather services[1]

George P. Cressman
National Weather Service, NOAA
Silver Spring, Md.

Introduction

Practically everybody having some remote connection with the profession of meteorology knows a good bit about the uses of public weather services. Naturally, we are all members of the public and we all have our opinions. But there are relatively small amounts of real information on the uses of pubic weather services that would be considered acceptable in a scientific meeting. A close examination of past literature on this subject reveals much information on specific incidents or requirements, but there is little except speculation on overall public uses of weather information. Nevertheless, a few useful surveys and related data are available.

Before describing the available data, I need to say what is meant by public weather services. These are the weather services provided for all members of the general public which are not specialized for use by a particular segment of the economy. For example, public weather services include warnings of severe weather and forecasts of weather, temperature, and other elements of general interest up to 5 days in advance. They exclude weather services specifically for agriculture, aviation, shipping, forestry, and other special activities. For purposes of this talk we can understand forecasts of atmospheric stagnation events as public weather services, since they are required for public health and safety.

The data bearing on the question

The only recent survey of public weather service requirements sponsored by the National Weather Service was done for us in 1966 by the National Bureau of Standards. It concentrated on the requirements, attitudes, and opinions of the public in two cities—Denver and Baltimore.

A second survey, much more comprehensive than the first, is still being conducted for the American Telephone and Telegraph Company. AT&T has kept the National Weather Service up to date on the results achieved so far. Their survey is designed to determine requirements for telephone weather services and is obtaining much valuable data of a general nature. To date, AT&T has kindly made some preliminary conclusions available to us, although the complete statistics obtained will only be available later.

Other information relating to public requirements for and uses of weather services comes from the voluminous correspondence received by the National Weather Service. This alone could give misleading impressions, since a person won't usually take the trouble to write a letter unless he has a problem. Other information can be gleaned from data available on the volume of telephone calls received from the public at our weather stations.

Finally, special NOAA or NWS investigative teams survey the performance of the forecast and warning system after each natural disaster. These teams bring back additional information on the public uses of weather services. A special survey of public reaction to hurricane warnings was made for the National Weather Service after hurricane Camille. This will be described by Riley later in this session.[2]

Daily public weather forecasts

Practically all data available on the problem agree on the primary public needs for weather services, and allow their listing in a rough ranking according to the amount of demand for the information. This should not be interpreted as a listing in order of economic importance. There is such a small amount of data available on the economic benefits of public weather forecasts other than for severe weather warnings that a listing of this type would be mostly guesswork.

The list may contain a few surprises. One revealed by the AT&T survey must be mentioned separately. It is a psychological requirement for weather services. Apparently many people want the latest forecast simply because it reassures them. It shows that the U. S. government is watching the weather and that bad weather will arrive and depart more or less on schedule.

Moving on to the public requirements for weather information, which we assume reflect public uses, we have the following:

---

[1] Presented at the AMS 51st Annual Meeting, "The Atmospheric Sciences in the Service of Man," 11–14, January 1971, San Francisco, Calif.

[2] Riley, J. A., and K. P. Wilkinson, 1971: Public reaction to storm warning. Abstract in *Bull. Amer. Meteor. Soc.*, **51**, 1011.

1) *The current weather observation, mainly for current weather and temperature.* This is somewhat surprising, since we might suppose that the individual concerned could look out the window and read his window thermometer. At any rate there is no doubt about this. AT&T has just persuaded us to put the current weather at the beginning of a telephone message, to be followed by the forecast.

2) *Weather forecasts for all types of local or short range surface transportation activities.* This includes commuting, other local driving, and transportation for businesses. A small but persistent demand exists for driving weather along the way to distant locations the same day and several days ahead.

3) *Weather forecasts for outdoor sports and recreation.* This ranges from weather for golf or little league ball games to major league games. The users include both the spectators and the businesses related to the outdoor events in question.

4) *Weather information for outdoor workers such as police, construction workers, etc.* Construction firms can be included in this category. A survey by Travellers Research Center indicated that these firms could make much better use of weather information than they do at present. The potential economic benefits of doing so were indicated to be very substantial.

5) *Today's weather for mothers getting ready to send children to school.* This requirements generates quite a telephone load just before school hours.

6) *Weather needs, real or imagined, by school children just after school is over in the afternoon.* The economic benefit of this may be nil, but the telephone loading in mid-afternoon is an infallible indicator that school is out. You can see one reason why the National Weather Service is installing automatic multiple line telephone equipment wherever possible to handle the load without tying up scarce personnel in answering the constantly ringing telephones.

7) *Local forecasts for businessmen, especially retailers whose trade fluctuates with the weather.* Many business operations, ranging from bakeries to car washes, can adjust labor or product distribution to profit from weather changes.

8) *Weather forecasts for farmers and ranchers.* Normally one would expect these to be served by a specialized agricultural weather service. That is also their desire. But at the present a specialized service of this type has been funded for less than 20% of the nation and most farmers and ranchers have to "make do" with the general public weather service. Considerable dissatisfaction with this state of affairs has been expressed very frequently by those not yet served by a specialized agricultural weather service.

9) *Forecasts of atmospheric stagnation events needed by pollution control agencies.* These have been funded by Congress for 12 major cities so far. They provide the basic forecast information to enable the local control authorities to predict pollutant concentrations and to inaugurate control actions ranging from a shutdown of city incinerators to a complete ban on downtown automobile traffic.

10) *Severe weather warnings.* These are infrequent at any one place, but are the most important of all, according to both experience and surveys. I will reserve these for a separate discussion.

Frequent and accurate forecasts containing the bare essentials 6 to 24 hr in advance, with emphasis on the first 12 hr, are the primary public requirement, according to both experience and surveys. The need of the general public for longer range forecasts seems to be mostly limited to those planning trips of one kind or another. The primary need for longer-range forecasts has been expressed mainly by industry or agriculture. While the number of demands for long-range forecasts is small, very large economic stakes are sometimes involved. An interesting use of 5-day forecasts is the use of forecast temperature and precipitation in predicting spring floods from snow melt, both in the northern plains and in the western mountains.

Weather forecasts for people driving to distant cities are a major unfilled need. This information is in our system, but the problem is how to get it to the person who needs it. Individual telephone contacts with a forecaster are out of the question in nearly any city sizeable enough to have a nearby weather service office. If all the people needing the forecast called, hardly anybody would get through. As a consequence most people start driving and hope for the best.

The problem is how to handle the vast variety of possibilities by a means of mass dissemination. We are actively studying this problem and have a few ideas. One being tried in several cities is a special driving forecast, couched in general terms, covering main routes 300 to 400 mi from a city. These forecasts are put on special automatic telephone systems or are broadcast on the NWS vhf radio broadcasts. If we extend this type of forecast to cover several days' driving range, the same method will break down because the message will get too long. Present day technology is certainly equal to the task, but we need a solution that can be introduced at a reasonable cost. We intend to experiment with additional ways of providing this vital information.

Protection of life and property

The requirement to give adequate warning of severe weather to protect life and property is self-evident. It is also clearly indicated by public response during and after severe weather episodes. Since this requirement is not likely to be disputed, I won't try to justify it beyond the simple statement that it exists.

It may not be recognized that the National Weather Service provides warnings of a great variety of natural hazards. The list goes beyond hurricanes, tornadoes, and severe winter storms, extending to floods of both the slow-rising type and flash floods. For the last several years we have concentrated on improving warnings of storm surges of both hurricanes and winter storms and have had some success in providing warnings of heavy surf likely to cause beach erosion and coastal structural damage. These surf episodes are often due to storms far at sea, that send packages of high swells toward coastlines.

The potential for loss of property and life from these severe natural hazards is frightening. The possibility of their occurrence is likely to be forgotten because these hazards are rare at any one place.

For example, on 18 March 1925, a single tornado ran a course of 219 mi on the ground, going through parts of Missouri, Illinois, and Indiana. It laid waste everything in its path, killing 742 people and injuring 2771 more.

Think what a similar storm could do now, perhaps coming during the early morning hours through an area with a much higher population density. The public could only be reached and awakened with warnings at such an hour by the use of sirens. We are able to use sirens directly in only a few communities, but are working with Civil Defense to extend this type of warning or to find a better and perhaps more modern or effective way.

A different kind of problem comes from hurricanes. An estimated 100,000 people were evacuated during hurricane Camille of 1969. Many coastal areas have been subject to mushrooming construction of dwellings during the last decade due to the pressure of increasing population. Dr. R. H. Simpson has recently pointed out that some of this construction is taking place without the provision of adequate escape routes for the population in case of hurricanes. In some cases 12 hr at the most are available for evacuation of great numbers of people. This might have to be done over inadequate low-lying roads or flimsy bridges that would likely become unuseable at an early hour, cutting off escape for large numbers of people. I want to emphasize that the magnitude of this problem is quite new.

A related problem exists where the pressure of vacationers for seaside housing has led to extensive construction of vacation housing directly on exposed beaches. A good example is found on the U. S. east coast, where in March of 1962 a storm surge and heavy surf washed out the ocean side blocks of several resort towns, ruined roads, and made extensive changes in the local geography. Now, expensive new construction has taken place much closer to the ocean than before. The next storm of this type will result in damages that could make the 1962 damages look minor. Climatological records indicate that we can expect a storm of this type once every 20 years. But we can't assume that this means necessarily a 20-yr interval between them. We have an equal exposure every year.

In some areas local authorities are now permitting housing construction on flood plains where the occurrence of a costly and damaging flood is only a matter of time. One major city has decided to reimburse former residents who were granted building permits in a known flood plain, only to have their houses and possessions suddenly wiped out by flash floods.

The National Weather Service is placing great emphasis on improvement of data networks—upper air, surface, and radar. The Air Weather Service and Naval Weather Service Command are in an intensive program of improving weather reconnaissance facilities. The National Weather Service is intensifying its activities in improvement of forecasts and warnings of storm surges. We are placing greater emphasis on education of the public concerning severe storms and how to survive. But the stakes are getting much greater. The public exposure to loss of life and property is increasing in spite of our best efforts in providing warning services.

This new aspect of increasing population, increased exposure of large numbers of people to environmental hazards, places a double burden on the profession. Warning systems must be much more effective than before if increasingly severe disasters are to be avoided. At the same time we have to find a way to reverse the trend toward needless exposure of people and property in known areas of danger.

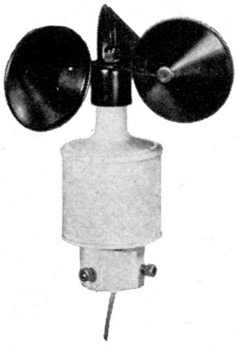
The standard reaction of good meteorologists will be to try harder for earlier and more accurate warnings, and we will do this. However, it is well accepted that there are intrinsic limitations on atmospheric predictability. The warning interval cannot be lengthened indefinitely.

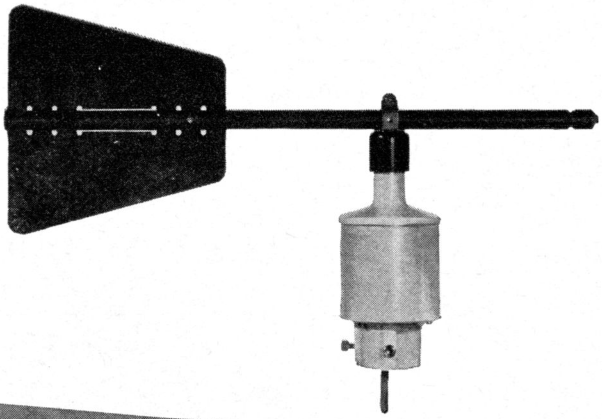
Other remedies cannot be neglected. For example, we need a universal alerting system. Although the cooperation of newspapers, radio and television enables near-saturation of the communications media with warnings and advisories when a hurricane approaches the gulf coast, there still may be a problem if a warning situation begins at night, when people are in bed. If it is a hurricane, and enough daylight hours will be available for evacuation, there is no problem—but if there is a tornado coming, or if a hurricane evacuation must take place before morning, there are two problems: First, can we intrude on people's privacy to wake them up? And, second, if so, how do we do it?

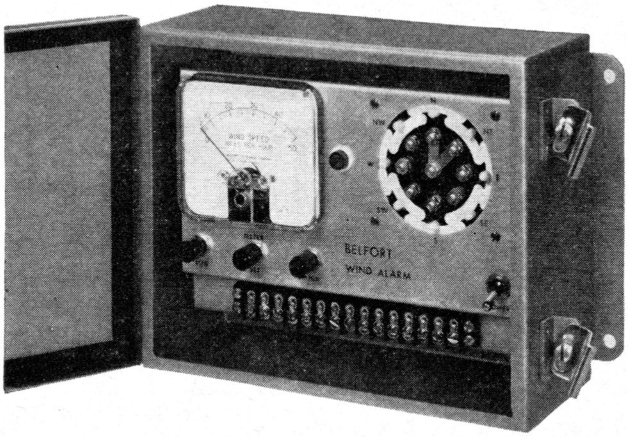
We also need a completely different type of action. A way must be found to ensure that usable evacuation routes are available or constructed before building permits are granted in large numbers for areas exposed to hurricanes or periodic high water. Considering the complexities of federal, state and local jurisdictions, this won't be easy.

Insurance companies may provide the eventual curb on high-density housing in areas vulnerable to high seas or flash floods. But, judging from present construction activity, this has not happened yet.

Having become aware of this type of problem we are studying ways of finding a solution. We can only hope to find a way before the forces of nature take charge and impose their own solution.







Type "C" Wind Alarm

CONTINUOUSLY MONITORS WIND SPEED AND DIRECTION TO SOUND AN ALARM OR INITIATE A CONTROL FUNCTION WHEN A PRE-PROGRAMMED SET OF WIND CONDITIONS IS PRESENT.

FOR: CONTROL OF AIR DISPERSED MATTER
WARNING OF HAZARDOUS MACHINERY OPERATING CONDITIONS
DANGER WARNING TO SWIMMERS AND BOATERS
AUTOMATIC WATER FOUNTAIN AND SPRINKLER CONTROL

USES STANDARD BELFORT TYPE "C" TRANSMITTERS

PROVIDES BOTH INDICATOR AND CONTROL

WIND SPEED OR DIRECTION OR BOTH IN COMBINATION

MANY OPTIONS

BELFORT ®

BELFORT INSTRUMENT COMPANY
1600 S. CLINTON STREET
BALTIMORE, MARYLAND 21224 U.S.A.